Preparation of the Structure Preliminary Geotechnical Report (SPGR)

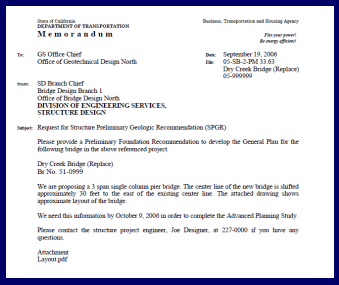
Geotechnical Reports are prepared for:

- Bridges
- Retaining walls
- Buildings

Structure Preliminary Geotechnical Report Preparation

- Contents of the request from Structure Design
- Elements of an SPGR per MTD 1-35
- Some of the activities GS performs when preparing an SPGR illustrated with the fictitious Dry Creek Bridge

To support the preparation of the Advanced Planning Study, SD provides the following data in a request for a SPGR:



State of California
DEPARTMENT OF TRANSPORTATION
Memorandum

Business, Transportation and Housing Agency

File your power!
Be energy efficient!

To: GS Office Chief
Office of Geotechnical Design North

Date: September 19, 2006
File: 05-SB-2-PM 33.63
Dry Creek Bridge (Replace)
05-000000

From: SD Branch Chief
Bridge Design Branch 1
Office of Bridge Design North
DIVISION OF ENGINEERING SERVICES,
STRUCTURE DESIGN

Subject: Request for Structure Preliminary Geologic Recommendation (SPGR)

Please provide a Preliminary Foundation Recommendation to develop the General Plan for the following bridge in the above referenced project.

Dry Creek Bridge (Replace)
Br No. 51-0999

We are proposing a 3 span single column pier bridge. The center line of the new bridge is shifted approximately 30 feet to the east of the existing center line. The attached drawing shows approximate layout of the bridge.

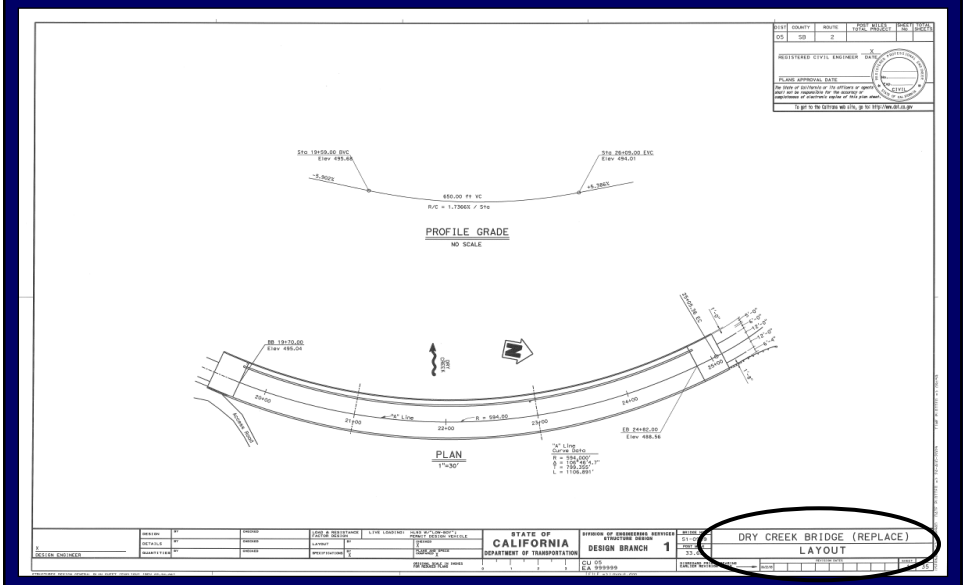
We need this information by October 9, 2006 in order to complete the Advanced Planning Study.

Please contact the structure project engineer, Joe Designer, at 227-0000 if you have any questions.

Attachment
Layout.pdf

- Location plan or strip map
- Aerial photographs (if available)
- As-Builts (if available)
- Scope and possible structure type
- Proposed foundation locations (if known)
- Potential for scour (if known)
- Types of foundations being considered
- SPGR due date

Per MTD 1-35 – June 2008



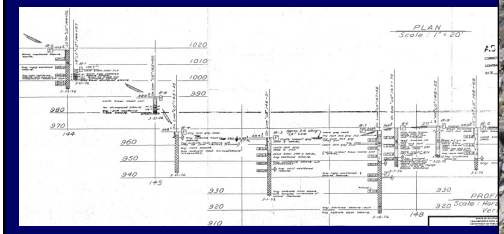
The SPGR should include the following:

- Subsurface conditions, including groundwater
- Geologic hazards
- Seismic information
- Feasible foundation type(s) for site
- Potential construction issues
- Initial corrosion evaluation
- Identification of potential for Construction phase Foundation Load Test(s)

Per MTD 1-35 – June 2008

Define the subsurface conditions: soil and rock

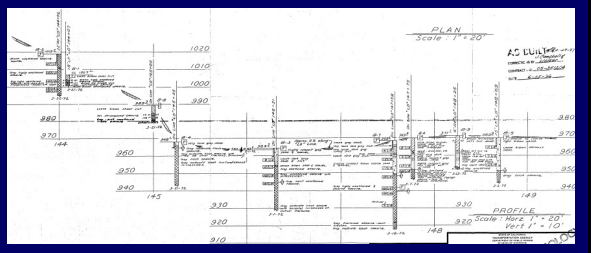
- Soil and rock types present at the project site
- Vertical and lateral distribution of soil and rock
- Strengths of foundation soil and rock



Information is found on existing borehole logs, lab test records, and geologic maps. A site inspection is invaluable.

Define the subsurface conditions: groundwater

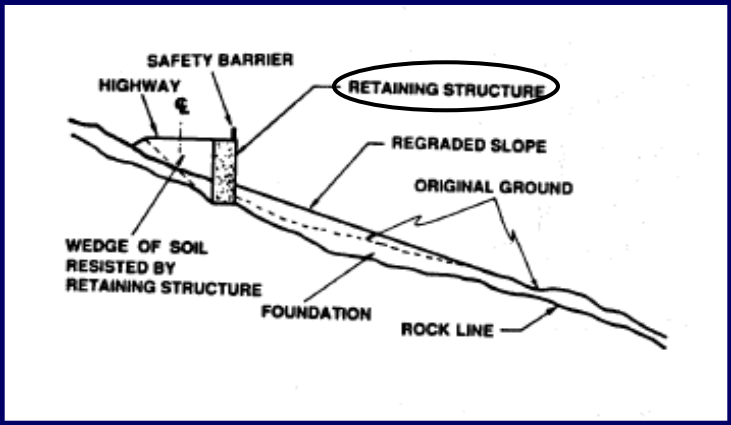
- Elevations and locations of saturated soil and rock with water filled discontinuities
- Seasonal changes to the location(s) of groundwater



Information is found on existing borehole logs, in foundation reports, and in the records of other agencies. A site inspection also provides valuable information.

Identify the potential geologic hazards

Is there an existing slope instability that would impact the structure?



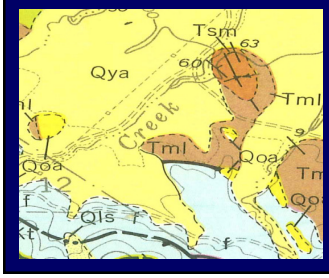
Could a slope instability develop in the future???

Identify the potential geologic hazards

Vertical and lateral river channel erosion (degradation) may reduce the stability of the approach embankments or foundations.

Identify the potential geologic hazards

- Slope instabilities
- Expansive soil
- Collapsible soil
- Ground subsidence – karst, caves, mines, soil consolidation, peat oxidation
- Scour



- Site inspection
- Topographic maps
- Geologic maps and reports
- Soil survey maps and reports
- Foundation reports and other professional reports
- Bridge maintenance records
- Hydraulic reports

Seismic information in the SPGR

- Potential for fault rupture hazard
- Design Peak Bedrock Acceleration (PBA)
- Design earthquake magnitude (M)
- Soil Profile Type
- Potential for liquefaction, lateral spreading and other secondary seismic hazards

Consider all of the feasible bridge foundation types

- Shallow foundations
  - Spread footing
  - Trench footing
- Deep foundations
  - Driven piles
    - Standard plan Class piles
    - Nonstandard plan piles types such as large diameter pipe piles and CISS piles
  - Drilled shafts (CIDH piles)
    - Standard plan 16 inch diameter drilled shafts
    - Nonstandard plan piles larger than 16 inches in diameter

Spread footing foundation

Driven piles

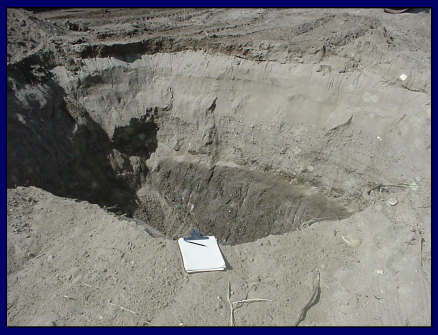
Driven pile alternatives

Drilled shaft alternatives

Potential construction issues for driven pile foundations

- Obstructions to pile driving
- Driveability of the pile/hammer/foundation material system

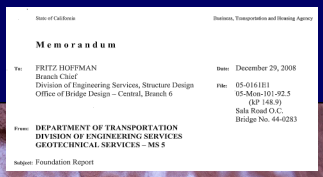
Potential construction issues for drilled shaft foundations



- Obstructions to drilled shaft excavation
- Caving of drilled shaft excavations
- Complications associated with the presence and volume of groundwater inflows

Initial corrosion evaluation

- Chlorides, sulfates and pH
- Concrete mix design
- Concrete cover over reinforcing steel
- Sacrificial section or cathodic protection of steel members



State of California — Business, Transportation and Housing Agency

Memorandum

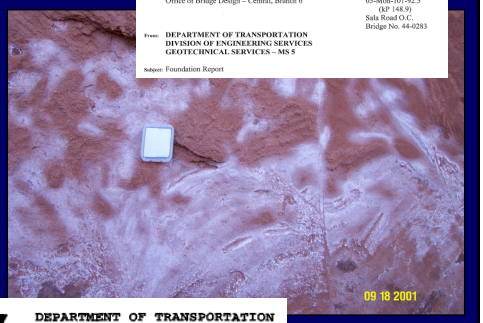
To: FRITZ HOFFMAN
Branch Chief
Division of Engineering Services, Structure Design
Office of Bridge Design – Central, Branch 6

Date: December 29, 2008

File: 05-016IE1
05-Mon-101-92.5
(kP 148.9)
Sala Road O.C.
Bridge No. 44-0283

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: Foundation Report



Caltrans
DEPARTMENT OF TRANSPORTATION
Structure Maintenance & Investigations

Bridge Inspection Report

Identification of a potential requirement for construction phase Foundation Load Tests

- A static pile load test is justified where:
  - Unusual or unknown foundation conditions
  - Little or no foundation redundancy
- Early identification of need for a static pile load test is good practice because:
  - Want to include in programmed cost estimate
  - Test has both associated construction cost and construction days

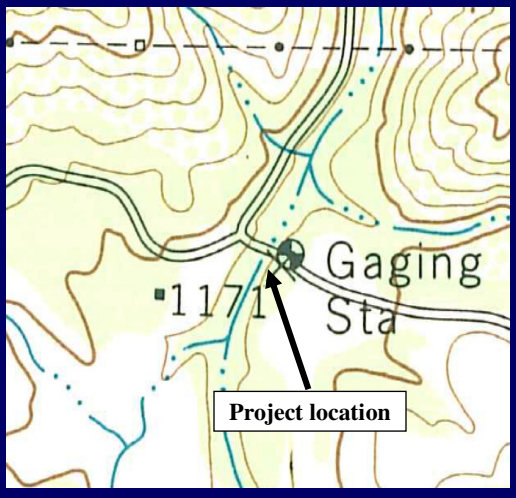
Sections of the Structure Preliminary Geotechnical Report (SPGR)

- Project description and scope
- Existing facilities and proposed improvements
- Physical setting
- Geology and soil conditions
- Ground water conditions
- Seismicity
- Liquefaction

Prepare an SPGR for the Dry Creek Bridge Replacement

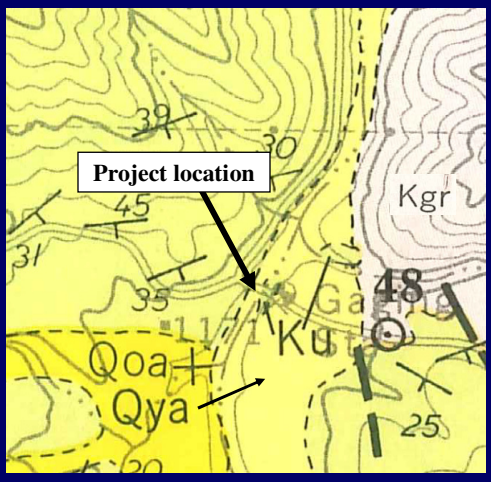
- Review the existing data
  - Topographic map
  - Geologic map and report
  - Fault hazard maps
  - Soil survey maps
  - As-built plans including LOTBs
  - Bridge maintenance records
- Inspect the project site
  - Bridge footprint
  - Adjacent slopes

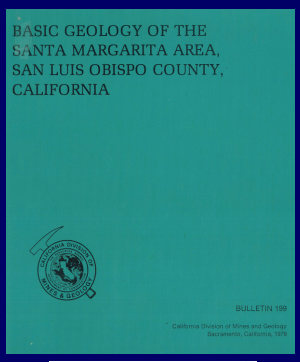
Topographic map



- Ground surface elevations
- Cultural features
- Presence of springs
- Location of access roads
- Topographic patterns that may indicate the presence of a slope instability

Geologic map and report





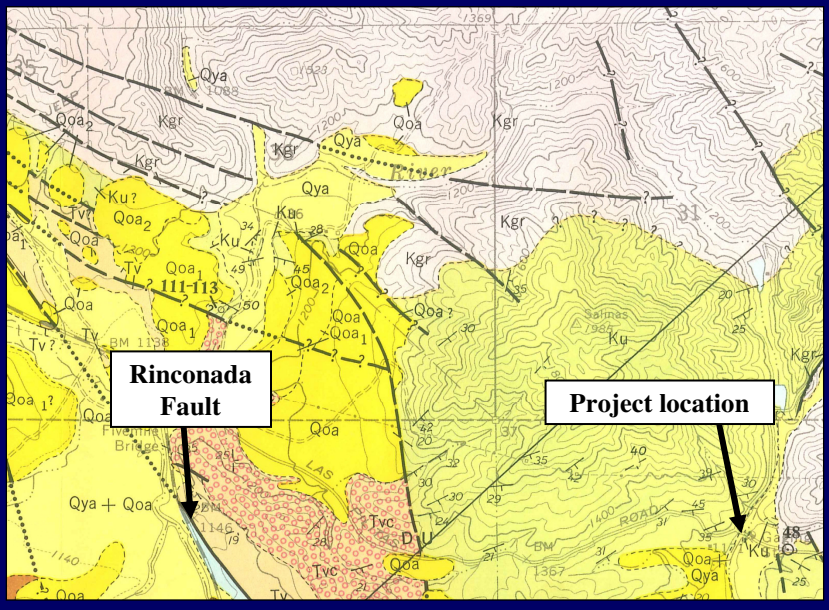
Qya

Younger alluvium

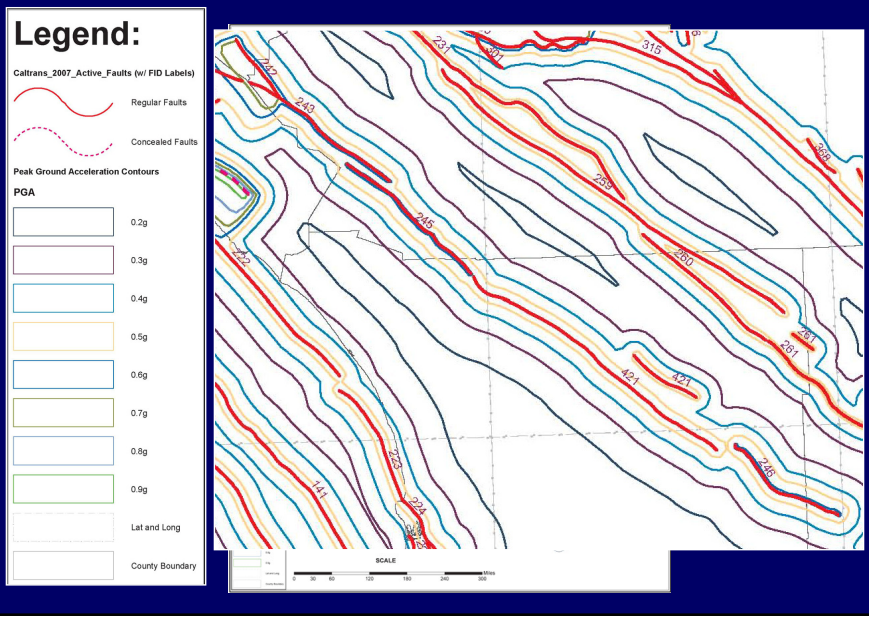
Ku

Unnamed sandstone and conglomerate

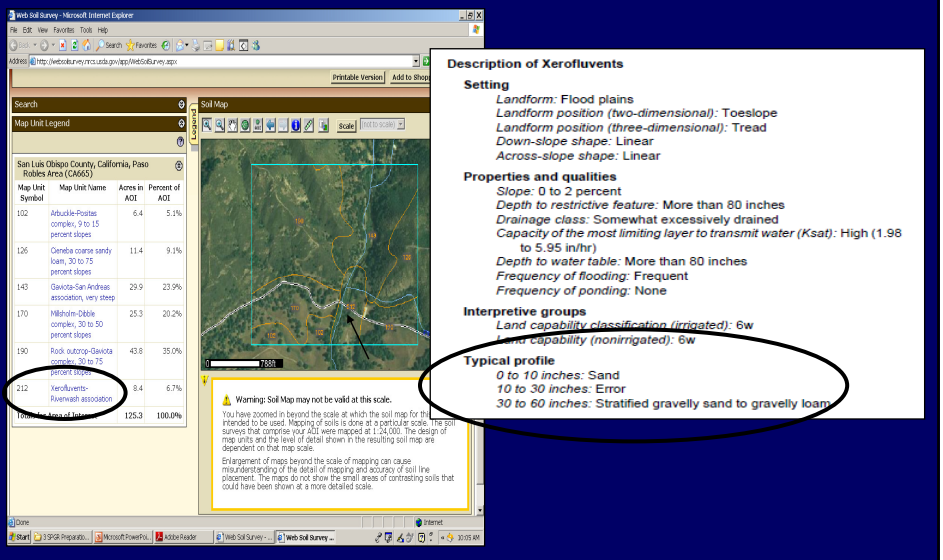
Geologic map showing fault locations



Deterministic Fault Hazard Map



Soil survey map



As-built LOTBs and bridge maintenance records

The existing structure is supported on a foundation consisting of spread footings at abutment 1, and 10 to 40 foot long driven timber piles at the piers and abutment 4.

Site inspection

Looking west at the old bridge with the proposed bridge to be located in the foreground

Site inspection photographs of Abutment 1

Site inspection photographs of Pier 2

Site inspection photographs of Pier 3

Site inspection photographs of Abutment 4

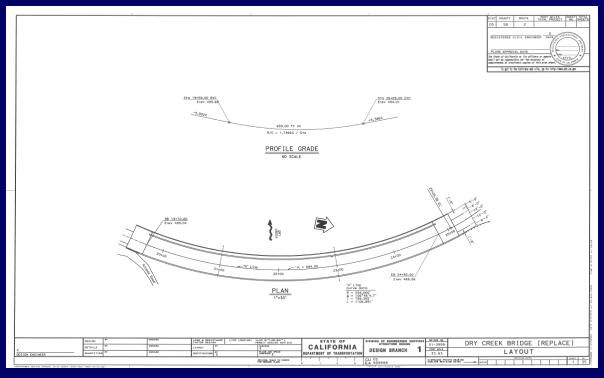
Observe the rock outcrops

Observe the rock outcrops

Findings presented in the SPGR

- The existing structure is supported on a foundation consisting of spread footings at abutment 1, and 10 to 40 foot long driven timber piles at the piers and abutment 4.
- The project site is underlain by sandstone at, or near the surface of abutment 1 and pier 2. Sandstone is expected between 20 and 40 feet deep at pier 3 and abutment 4, below soil that is expected to be primarily sand.
- Groundwater is expected a few feet below the ground surface most of the year.

Recommendations presented in the SPGR



1. Foundation alternatives for the new structure include spread footings and drilled shafts at the abutments, and groups of driven Class piles or 24 to 36 inch diameter drilled shafts at the piers.
2. The foundation investigation should consist of one borehole per support.
3. In consideration of the structure width, importance, and redundancy of the foundation elements, the need for a pile load test during construction is not anticipated. Concrete integrity testing may be required.

Not done yet…need to begin development of a site exploration plan

- Estimate the number and location of boreholes, and the need for long-term access to completed borehole (piezometers, slope inclinometers)
- Estimate the number and location of exploratory trenches and geophysical testing
- Determine if Right of Way support is needed to get legal permission for physical access to borehole and testing locations
- Determine if Environmental permits are required to conduct the required field investigation testing and monitoring…and begin process of securing the permits
  - Army corps of engineers
  - Fish and game
  - Coastal commission
  - County
  - Regional Water Quality Control Board

Next step:

The Preliminary Foundation Report (PFR)

To support the preparation of the Draft Structural General Plan, SD requests a PFR:

State of California
DEPARTMENT OF TRANSPORTATION
Memorandum

Business, Transportation and Housing Agency

Flex your power!
Be energy efficient!

To: GS Office Chief
Office of Geotechnical Design North

Date: July 11, 2008
File: 05-SB-2-PM 33.63
Dry Creek Bridge (Replace)
05-999999

From: SD Branch Chief
Bridge Design Branch 1
Office of Bridge Design North
DIVISION OF ENGINEERING SERVICES,
STRUCTURE DESIGN

Subject: Request for Preliminary Foundation Recommendation (PFR)

Please provide a Preliminary Foundation Recommendation to develop the General Plan for the following bridge in the above referenced project.

Dry Creek Bridge (Replace)
Br No. 51-0999

We are proposing a 3 span single column pier bridge. The center line of the new bridge is shifted approximately 50 feet to the east of the existing center line. The attached drawing shows approximate support locations for the bridge.

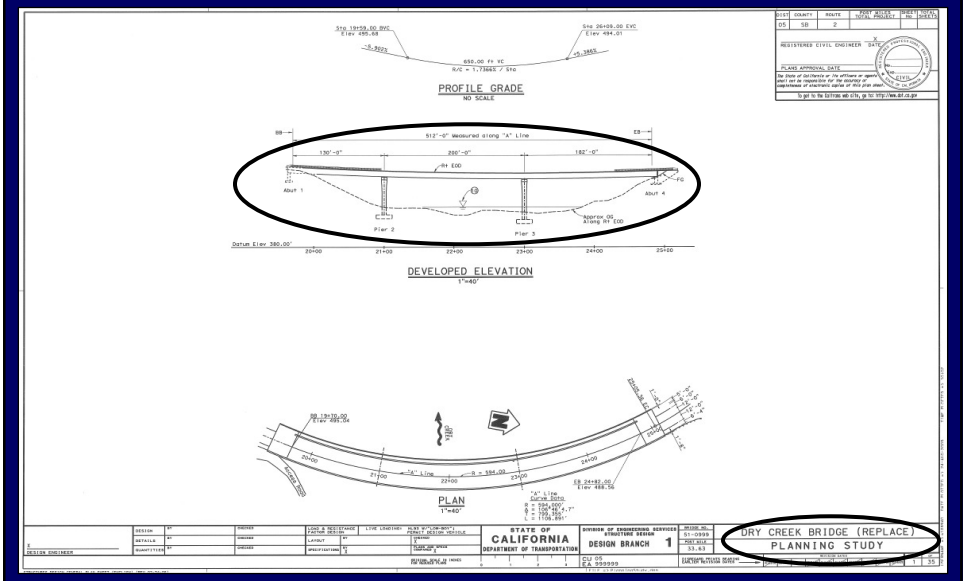
We need this information by August 1, 2008 in order to complete the General Plans on schedule.

Please contact the structure project engineer, Joe Designer, at 227-0000 if you have any questions.

Attachment
Layout.pdf

SD provides the following data in a request for a PFR:

- Location and site plans
- Scope of proposed work
- Preliminary layout of structure and foundations
- (An Advanced Planning Study (APS) is provided, if available.)
- Copy of the SPGR
- Preliminary design loads on the foundation
- ("Preliminary Foundation Design Data Sheet" from MTD 3-1 or 4-1)
- Scour data, or if available, a Preliminary Hydraulics Report
- Types of foundations being considered by SD
- Information concerning retaining walls on the project
- Project schedule
  - Draft Structure General Plan distribution target date
  - Name and phone number of Structures PE
- PFR due date



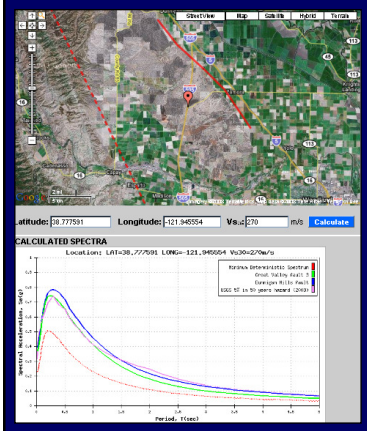
Preliminary Foundation Design Data Sheet

Support	Foundation Type(s) Considered	Estimate of Maximum Factored Compression Loads (kips)
Abut 1	16 inch CIDH piles, or Spread footing	140 kips per pile
Pier 2	Group of Class 200 Piles Group of 24 inch diameter drilled shafts	200 kips per pile 200 kips per pile
Pier 3	Group of Class 200 Piles Group of 24 inch diameter drilled shafts	200 kips per pile 200 kips per pile
Abut 4	16 inch CIDH piles, or Spread footing	140 kips per pile

Notes:

1. *Estimate of maximum factored loads is not required for standard piles*
2. *Estimated maximum factored loads will be based on: Strength Limit State for bents and Service-I Limit State for abutments.*

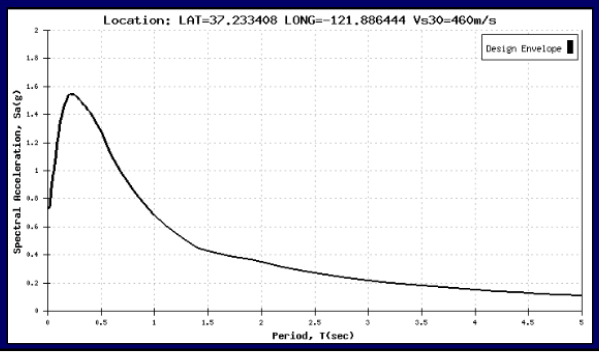
The PFR should include the following:



- Subsurface conditions, including groundwater
- Geologic hazards
- Seismic information*
- Appropriate foundation type(s)
- Recommended foundation type(s)*
- Foundation constructability
- Corrosion and hazardous waste evaluation
- Anticipated site investigation program
  - Permits needed for entry to project location
  - Duration and schedule of the site investigation program (includes boreholes, trenches, etc.)
- Revised plan for field work and laboratory tests

Seismic information in the PFR

- Fault surface rupture potential
- Design Peak Bedrock Acceleration (PBA)
- Design earthquake magnitude (M)
- Soil Profile Type
- Recommended preliminary ARS curve
- Potential for liquefaction, lateral spreading and other secondary seismic hazards
- Additional work needed to develop final recommendations



Recommended foundation type(s)

- Abutments 1 and 4
  - Spread footing
  - 24 inch (increased from 16) diameter drilled shafts
- Pi
  -
  - nches
  -

Sections of the Preliminary Foundation Report (PFR)

- Project description and scope
- Existing facilities and proposed improvements
- Physical setting
- Geology and soil conditions
- Ground water conditions
- Seismicity
- Liquefaction
- Recommended foundation types and associated constructability issues

In review, recommendations found in the PFR but not in the SPGR

- Recommended preliminary ARS curve
- Recommended foundation types per support
- Hazardous waste issues that may influence foundation type selection, construction procedures or cost
- Revised and/or more complete scope of the planned foundation investigation.
- Foundation investigation schedule and anticipated permitting requirements.

After the type selection meeting, the request for the Foundation Report is received.

Dave Thomas will discuss how GS proceeds with the Geotechnical Field Investigation.